PERIOPERATIVE OUTCOME IN PATIENTS WITH ACUTE LOWER EXTREMITY ISCHEMIA

Dissertation submitted to

THE TAMILNADU Dr. M. G. R. MEDICAL UNIVERSITY

In partial fulfillment of the

regulations for the award of the degree of

M.Ch(VASCULAR SURGERY)

BRANCH-VIII

THE TAMIL NADU DR. MGR. MEDICAL UNIVERSITY

CHENNAI, INDIA

AUGUST 2009

DECLARATION

I solemnly declare that this dissertation **"PERIOPERATIVE OUTCOME IN PATIENTS WITH ACUTE LOWER EXTREMITY ISCHEMIA"** was prepared by me in the Department of Vascular Surgery, Government General Hospital, Madras Medical College, Chennai under the guidance and supervision of **Prof. T.VIDYASAGARAN, MS, DNB, M.Ch**., Professor & Head of the Department, Department of Vascular Surgery, Government General Hospital, Madras Medical College, Chennai. This dissertation is submitted to the Tamil Nadu Dr.MGR Medical University, Chennai in partial fulfillment of the University requirements for the award of degree of M.Ch., Vascular Surgery.

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CERTIFICATE

This is to certify that this dissertation entitled **"PERIOPERATIVE OUTCOME IN PATIENTS WITH ACUTE LOWER EXTREMITY ISCHEMIA"** is a bonafide record of the research work done by Dr. Rajarajan V, for the award of M.Ch., Vascular Surgery, under the supervision of **Prof. T. VIDYASAGARAN MS, DNB, MCH,** Professor & Head, Department of Vascular Surgery, Government General Hospital, Madras Medical College, Chennai. I also certify that this dissertation is the result of the independent work done by the candidate.

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ACKNOWLEDGEMENTS

I gratefully and sincerely acknowledge the Dean, Madras Medical College, Chennai for granting me permission to utilize the facilities of the institution to pursue this study.

I hereby wish to express my gratitude to Prof T Vidyasagaran, HOD, Vascular Surgery who with his limitless patience and appropriate guidance helped me in formulation of this dissertation. I would also like to acknowledge the valuable guidance provided by Prof J Amalorpavanathan, Unit Chief, Dept of Vascular Surgery, Madras Medical College.

I am indebted to my guide Dr. Ilayakumar. P and other Assistant Professors Dr. N. Sritharan, Dr. G. Thulasi Kumar, Dr. Bhaktavatchalam, Dr. Balakumar and Dr. Elancheralathan who have constantly guided me in the compilation of this dissertation.

I would also like to acknowledge the motivation and encouragement provided by retired Prof S A Hussain and Prof. RajKumar, HOD, Vascular Surgery, Stanley Medical college who with their untiring efforts and invaluable suggestions have helped me in this work.

I would also thank Dr. S. R. Subramanniyam, HOD, Dept. of Vascular surgery, Govt. Royapettah Hospital, Dr. Kamalakannan, HOD, Dept. of Vascular surgery, Kilpauk medical college and Dr. S. Saravanan for their constant support in my thesis work.

Last but not the least, I thank the patients who have willingly participated in this study and despite their ailments, placed their faith in us.

CONTENTS

ABBREVATIONS

DM – Diabetes mellitus

HTN – Hypertension

CAD – Coronary artery disease

CVA – Cerebrovascular accident

MS – Mitral stenosis

TTE – Transthoracic echocardiography

TEE – Transesophageal Echocardiography

CTA – Computed tomographic angiography

CFA – Common femoral artery

SFA – Superficial femoral artery

PFA – Profunda femoris artery

ATA – Anterior tibial artery

PTA – Posterior tibial artery

ABI – Ankle brachial index

ACCP – American College of Cardiologists and Physicians

PTA – Percutaneous Transluminal Angioplasty

TASC – TransAtlantic InterSoceity Consensus

INTRODUCTION

According to the 2007 Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II), acute limb ischemia is defined as a sudden decrease in limb perfusion that causes a potential threat to limb viability (manifested by ischemic rest pain, ischemic ulcers, and/or gangrene) in patients who present within two weeks of the acute event[1].

The management of acute arterial occlusion remains a challenge for vascular specialists. Surgical thromboembolectomy and bypass grafting were the mainstays of therapy for many years[2]. Subsequently, thrombolytic therapy and percutaneous transluminal angioplasty (PTA) have become treatment options for selected patients.

Despite these advances, the morbidity, mortality, and limb loss rates from acute lower extremity ischemia remain high. Thus, regardless of the treatment modality used, early diagnosis and rapid initiation of therapy are essential in order to salvage the ischemic extremity.

The best defense against limb loss is prompt initiation of therapy. Thus, once the diagnosis of acute arterial occlusion has been made by history and physical examination, the Seventh ACCP Consensus Conference on Antithrombotic Therapy recommends that the patient should immediately receive 10,000 units of intravenous heparin followed by a continuous heparin infusion[3]. Anticoagulation will prevent further propagation of thrombus, and inhibit thrombosis distally in the arterial and venous systems due to low flow and stasis. Time is crucial, the decision to administer heparin is based upon the

clinical evaluation and should not be delayed while waiting for diagnostic procedures to be performed.

Following the initiation of heparin, treatment then varies depending upon the viability of the limb. Options include surgery and thrombolytic therapy

Patients found to have an ischemic but viable extremity on clinical examination should undergo urgent arteriography in order to plan surgical or medical revascularization. There are several findings on arteriography which are used to determine if thrombolytic therapy, PTA, or surgical revascularization is the most appropriate treatment. These include:

- The presumed etiology (embolus versus thrombus)
- The location and length of the lesion
- The duration of symptoms
- The availability of autologous vein for bypass grafting
- The suitability of the patient for surgery

Patients with a threatened extremity should undergo emergent surgical revascularization. The majority of these patients have had an embolic event, and irreversible changes can occur within as little as four to six hours of profound ischemia. While pharmacologic thrombolysis may successfully dissolve the embolus, the time required is usually too long to allow this to be an acceptable alternative to surgery.

Patients with nonviable extremities should undergo prompt amputation. Arteriography is usually not necessary, since the level of amputation is determined by clinical findings and by the viability of tissues at the time of surgery. Every effort should be made to preserve as many joints as possible, in order to decrease the work of ambulating with a prosthesis and to improve the chances for successful rehabilitation. Delays in amputation of a nonviable extremity can result in infection, myoglobinuria, acute renal failure, and hyperkalemia and eventually death.

Extraction of emboli or thrombi by the use of an inflatable balloon catheter is considered as relatively a simple operation. However, perioperative mortality remains high and can be attributed to serious underlying cardiac disease or to the consequences of the reperfusion of the ischemic limb causing release of toxic metabolites.
Most studies report a 30 day mortality exceeding 20% and amputation rates above 10% following arterial embolectomy[4,5,6].

This study is to evaluate the perioperative outcome in patients presenting with first episode of acute arterial occlusion of lower extremity.

ACUTE LIMB ISCHEMIA

PATHOPHYSIOLOGY

Acute limb ischemia may occur as the result of embolization or in-situ thrombosis (Table.1). Emboli originate from the heart in more than 90% of cases[7] and normally lodge at the site of an arterial bifurcation such as the distal common femoral or popliteal arteries. The decreasing prevalence of rheumatic heart disease underlies a diminishing proportion of embolic versus thrombotic causes for acute limb ischemia. When embolization occurs, it usually does so in the setting of atrial fibrillation or acute myocardial infarction, when portions of atrial or ventricular mural thrombus detach and embolize to the arterial tree.

Table.1 Classification of Acute Limb Ischemia
Bypass graft occlusion
Prosthetic conduit
Intimal hyperplasia at the anastomoses(usually distal)
Occlusion without a demonstrable lesion
Autogenous conduit (e.g., saphenous vein graft)
Retained valve cusp of an in-situ graft
Stenosis at the site of a prior venous injury(e.g., superficial phlebitis)
Native arterial occlusion
Thrombosis at the site of an atherosclerotic stenotic lesion
Embolism to an arterial bifurcation
Thrombosis within a near-normal artery, usually as the result of a hypercoagulable state
Arterial inflammatory diseases such as giant cell arteritis (Takayasu's aortitis)
Thrombosis of an aneurysm (e.g., popliteal aneurysm)
Rare etiologies (e.g., popliteal entrapment syndrome, adventitial cystic disease of the popliteal artery)

It is often difficult to distinguish embolus from thrombosis, but embolic occlusions should be suspected in patients with the following features:

- acute onset where the patient is often able to accurately time the moment of the event
- prior history of embolism
- known embolic source, such as cardiac arrhythmias
- no prior history of intermittent claudication
- normal pulse and Doppler examination in the unaffected limb.

Thrombosis as an etiology for acute limb ischemia is a much more diverse category than embolization. With the increased use of peripheral arterial bypass grafts for chronic limb ischemia, and noting the finite patency rate of any bypass graft conduit, it is not surprising that acute graft occlusion is now the most frequent cause of acute lower extremity ischemia in most centers.

Symptoms may be less dramatic than embolic occlusion, depending on the extent of collateral flow across the site of occlusion. In addition to the presence of collateral channels, the location of the occlusion may also play a critical role in the severity of limb ischemia. For example, occlusion of the popliteal artery results in profound limb ischemia, since it is the only artery crossing at the level of the knee. By contrast, occlusion of the anterior tibial artery is often asymptomatic because the posterior tibial and peroneal arteries can function as alternate parallel channels to supply the foot.

Irrespective of the etiology of ischemia, the end result is the build-up of toxic byproducts within the ischemic tissue bed. These toxins include the free radicals, which are oxygen-derived, chemically reactive molecules that are responsible for the injury that occurs after ischemia and reperfusion. Ischemia induces leakage of protein and fluid from the capillary bed, resulting in tissue edema[8].

Hydrodynamic pressure in the extravascular space rises to a level that competes with venous outflow, perpetuating a vicious cycle that can eventually impede arterial inflow. At first, this process occurs at a microscopic level, but it may progress to the development of high tissue pressures at a regional level and the clinical entity known as the *compartment syndrome*. The development of a compartment syndrome is hastened by the abrupt reperfusion of a previously ischemic tissue bed, a phenomenon that explains the relatively frequent need for fasciotomy after lower extremity surgical revascularization for severe limb ischemia[9].

DIAGNOSIS

Acute limb ischemia is a clinical diagnosis. Patients complain of numbness and pain in the extremity, progressing in severe cases to motor loss and muscle rigidity. Examination reveals the absence of palpable pulses, and the location of the pulse deficit allows one to predict the site of arterial occlusion.

The “5 Ps” have been used as a mnemonic to remember the presentation of a patient with acute limb ischemia.

Paresthesia

Pain

Pallor

Pulselessness

Paralysis

In some cases, a sixth P is added—Poikilothermia, meaning equilibration of the temperature of the limb to that of the ambient environment (coolness). The process is sometimes confused with deep venous thrombosis by an inexperienced observer.

Although a deep venous thrombosis may manifest as limb ischemia when severe (phlegmasia cerulea dolens), profound lower extremity edema is uncommon in pure arterial ischemia. Occasionally, a patient with arterial ischemia and pain at rest keeps the extremity in a dependent position and edema may develop; such a scenario may be apparent if an adequate history is obtained. Pain may either be constant or elicited by passive movement of the involved extremity.

History should include a description of the duration, location, intensity, and suddenness of the onset of pain and change over time. Embolic occlusions are usually quite sudden and of great intensity, such that patients often present within a few hours of onset. The

past history should state whether or not the patient has a history of intermittent claudication, previous leg bypass or other vascular procedures, and history suggestive of embolic sources such as cardiac arrhythmias and aortic aneurysms.

General atherosclerotic risk factors (smoking, hypertension, diabetes, hyperlipidemia, family history of cardiac or vascular events) should be recorded because these can be predictors of periprocedural mortality.

In an effort to classify the extent of acute ischemia for standardization reporting of outcome, the Society for Vascular Surgery/International Society for Cardiovascular Surgery (SVS/ISCVS) (now SVS) ad hoc committee was established and published what has now come to be known as the *Rutherford criteria*, after Dr. Robert Rutherford[10].

The following three classes were defined:

- Class 1: the limb is viable and remains so even without therapeutic intervention.
- Class 2: the limbs are threatened and require revascularization for salvage.
- Class 3: those limbs that are irreversibly ischemic and infarction has developed such that salvage is not possible.

The initial work of the reporting standards committee was revised several years later[11], dividing the middle category into two subclassifications:

- Class 2A for limbs that are not immediately threatened
- Class 2B for those limbs that are severely threatened to the point where urgent revascularization is necessary for salvage.

The anatomic level of the arterial stenoses can be predicted from palpation of pulses in the femoral, popliteal, and ankle regions. Even the most astute clinician sometimes has difficulty in discerning his or her own digital pulse from the patient's pedal pulse.

Hence, the use of a Doppler instrument is advantageous to document the flow status in the both the pedal arteries and also the venous flow at the ankle level to provide an objective and quantitative assessment of the extent of arterial insufficiency[12]. The severity of ischemia classification to that of the Doppler flow signals by Dr. Rutherford is shown in the table below.

Category	**Description/prognosis**	**Findings**		**Doppler signals**[†]	
		Sensory loss	Muscle weakness	Arterial	Venous
I. Viable	Not immediately threatened	None	None	+	+
II. Threatened					
a. Marginal	Salvageable if promptly treated	Minimal (toes) or none	None	(Often) -	+
b. Immediate	Salvageable with immediate revascularization	More than toes, associated with rest pain	Mild, moderate	(Usually) -	+
III. Irreversible	Major tissue loss or permanent nerve damage inevitable	Profound, anesthetic	Profound, paralysis (rigor)	-	-

[†] Obtaining an ankle pressure is very important. However, in severe ALI, blood flow velocity in the affected arteries may be so low that Doppler signals are absent.

Differentiating between arterial and venous flow signals is vital: arterial flow signals will have a rhythmic sound (synchronous with cardiac rhythm) whereas venous signals are more constant and may be affected by respiratory movements or be augmented by distal compression (caution needs to be taken not to compress the vessels with the transducer).Reproduced from Rutherford RB et al. J Vasc Surg 1997;26(3):517–538.

In some centers, transcutaneous oxygen tension has also been used to assess the severity of peripheral arterial occlusion[13] as well as to predict the most appropriate level of amputation.

Duplex ultrasound is a non invasive test to define the anatomic extent of peripheral arterial disease[14]. Although duplex has been useful in documenting the patency of a single arterial segment such as a stented superficial femoral artery or a bypass graft, evaluation of the entire lower extremity arterial tree remains imprecise, and its adequacy as the sole diagnostic modality for planning a percutaneous or open surgical intervention remains controversial.

Contrast arteriography remains the gold standard with which all other tests must be compared.

Magnetic resonance (MR) angiography is being used with greater frequency in patients with peripheral arterial disease[15]. Using gadolinium as an MR contrast agent, the specificity and sensitivity of the test exceed that of duplex ultrasonography and approach the accuracy of standard arteriography. It has got the advantage in demonstrating patent tibial arteries undetected with less sensitive conventional arteriography, identifying potential target vessels for an otherwise unfeasible lower extremity reconstructive bypass procedure. Today, MRA is widely employed in patients with chronic renal insufficiency to limit the dye load.

Another noninvasive imaging modality, computed tomographic (CT) angiography, is gaining appeal as a means of delineating anatomy to provide a means of localizing the

extent and severity of occlusive disease[16]. With future improvements in hardware and software technology, it is likely that MR and CT angiography will effectively replace conventional diagnostic arteriography, and arterial cannulation will be reserved solely for percutaneous interventional therapies.

TREATMENT

Acute lower extremity peripheral arterial occlusion may culminate in major amputation if revascularization is not undertaken in a prompt and efficient manner. There exist two standard treatment modalities for improving lower extremity arterial perfusion: operation and thrombolysis. Once the diagnosis is made, adequate systemic anticoagulation is instituted. A bolus of unfractionated heparin is standard, followed by a continuous infusion to maintain the activated partial thromboplastin time (aPTT) in a therapeutic range. The goal of anticoagulation is twofold: (1) to decrease the risk of thrombus propagation and (2) in the case of presumed embolic occlusion, to prevent recurrent embolization.

Routine blood studies and coagulation tests should be drawn before heparin is administered. A plain chest radiograph and electrocardiogram should be obtained in every patient. In patients with suspected embolism, an echocardiogram should be obtained as soon as time allows

There exist several basic therapeutic options to pursue in patients with acute limb ischemia:

1. The first option is anticoagulation alone. If the ischemia is nonthreatening (e.g., Rutherford class 1 or 2A), such a nonaggressive course may be appropriate. Angiographic evaluation and elective revascularization may then be undertaken after the patient has been fully prepared and other co-morbidities such as concurrent coronary artery disease have been addressed.
2. Patients who present with more severe ischemia (Rutherford class 2B) require some form of intervention to prevent progression to irreversible ischemia and limb loss. These patients should undergo early angiographic evaluation with adequate imaging of the affected and the unaffected extremity. Arterial access is accomplished at a site distant from the ischemic extremity using a contralateral femoral artery or brachial approach to avoid the creation of needle entry sites in an artery that might subsequently be infused with a thrombolytic agent.

Early angiographic imaging should be undertaken in all patients, with the sole exception of those patients with common femoral emboli. These individuals can be taken directly to the operating room for embolectomy, but intraoperative completion angiography is necessary to rule out retained thromboembolic material[17].

Once adequate diagnostic information has been obtained from the angiogram, the clinician is in a position to make a decision on whether to pursue a percutaneous or open surgical option.

- Thrombolytic therapy: Thrombolytic therapy with the plasminogen activators (urokinase, alteplase, or reteplase) has been demonstrated to lower the morbidity and mortality when compared with a traditional approach of immediate operative revascularization[18,19]. These benefits appear to be especially prominent in patients with medical co-morbidities when early revascularization is necessary. The complication rate is high when such patients are taken urgently to open surgical revascularization without the ability to adequately prepare the patient for operation.
- Mechanical thrombectomy: Removal of intra-arterial thrombus with a mechanical device has gained popularity over the last several year[20,21]. Some devices rely on hydrodynamic, rheolytic forces to extract the thrombus, whereas others use rotating components to fragment the clot. Mechanical thrombectomy devices can be used in conjunction with pharmacologic thrombolysis.
- Immediate open surgical revascularization: Early operation has been remarkably effective in restoring adequate blood flow to an ischemic extremity. The relatively simple procedure of balloon catheter thromboembolectomy, however, has fallen into disfavor for all but embolic occlusions. The underlying lesion responsible for the thrombotic event must be identified and corrected to avoid early reocclusion. For this reason, long atherosclerotic occlusions are best treated with the placement of a bypass graft[22].

Unfortunately, immediate open surgical interventions have been associated with an unexpectedly high risk of major morbidity and mortality.

Blaisdell and associates first reported this finding, noting a 30% perioperative mortality rate in a review of more than 3000 patients in the published works from the 1960s and 1970s[23]. Although the results have improved since the publication of Blaisdell's landmark review, mortality rates continue to remain undesirably high. This observation appears to relate to the relatively common occurrence of cardiopulmonary complications developing in these medically compromised patients, patients who are ill prepared to undergo early operative intervention[18].

The severity of ischemia precludes adequate preoperative preparation of the patient, and complications such as perioperative myocardial infarction, cardiac arrhythmia, or pneumonia appear to underlie the unacceptable mortality rate in these patients. Additionally, wound complications and delayed healing are common in these patients. Hence, despite successful limb salvage, patient dissatisfaction is frequent.

The mortality rate from open surgical treatment of acute limb ischemia has been reconfirmed in numerous studies published after Blaisdell's landmark series.

Dale reviewed cases of nontraumatic extremity ischemia and observed an 11% mortality rate in those with embolism, versus 3% in those with acute thromboses[24]. Several years later, Jivegård and colleagues documented a mortality rate of 20% in patients presenting with acute arterial embolism or thrombosis, a finding that was explained by preexisting cardiac disease in these patients[25].

Pharmacologic Thrombolytic Therapy

Noting the high morbidity from primary open surgical revascularization in patients suffering from true limb-threatening lower limb ischemia, three randomized, prospective clinical trials were organized to compare thrombolytic therapy and immediate open surgical revascularization.

The first study, the Rochester series, compared urokinase to primary operation in a single-center experience of 114 patients presenting with what has subsequently been called *hyperacute ischemia*[18]. Patients enrolled in this trial all had severely threatened limbs (Rutherford class 2b) with mean symptom duration of approximately 2 days. After 1 year of follow-up, 84% of patients randomized to urokinase were alive compared with only 58% of patients randomized to primary operation By contrast, the rate of limb salvage was identical at 80% in the two groups.

The second prospective, randomized analysis of thrombolysis versus surgery was the Surgery or Thrombolysis for the Ischemic Lower Extremity (STILE) trial[19]. At its termination, 393 patients were randomized to one of three treatment groups: rt-PA, urokinase, or primary operation. Subsequently, the two thrombolytic groups were combined for purposes of data analysis when the outcome was found to be similar. Thrombolysis appeared more effective in patients with graft occlusions. The rate of major amputation was higher in native arterial occlusions treated with thrombolysis (10% thrombolysis vs. 0% surgery at 1 year). By contrast, amputation was lower in patients with acute graft occlusions treated with thrombolysis. These data suggest that

thrombolysis may be of greatest benefit in patients with acute bypass graft occlusions of less than 14 days.

The third and final randomized comparison of thrombolysis and surgery was the Thrombolysis or Peripheral Arterial Surgery (TOPAS) trial[26], funded by Abbott Laboratories. 544 patients were randomized to a recombinant form of urokinase or primary operative intervention. After a mean follow-up period of 1 year, the rate of amputation-free survival was similar in the two treatment groups: 68% and 69% in the urokinase and surgical patients, respectively

Percutaneous Mechanical Thrombectomy Devices

Numerous percutaneous mechanical thrombectomy (PMT) devices are currently available in the United States for dialysis graft declotting; however, only two devices are approved for infrainguinal arterial use in the United States. The devices may be classified into “aspiration” or “microfragmentation-only” devices. The latter embolize the microfragments that are created by the mechanical component of the device.

Many of these devices were designed primarily for dialysis graft declotting, where embolization is not seen as a device limitation. However, when used for peripheral arterial occlusion, the risk of downstream embolization is clinically significant.

REVIEW OF LITERATURE

In 1854, Virchow was the first to use the term *embolus* in the description of sudden obstruction of an artery by material that originated from a distal site. The term is derived from “embolos,” a Greek term meaning *plug*. The occlusive material may consist of platelet-fibrin thrombus, cholesterol debris, laminated aneurysmal thrombus, or a foreign body that has gained access to the vascular system.

Originally, the treatment of an arterial embolus was solely observational, which eventually terminated in limb loss or death. In 1911, the first successful arterial embolectomy was performed on the femoral artery by Labey[27].

In the early 1900s, the initial successful reports of surgical removal of embolic material were described and operative management slowly gained acceptance[24].

Non operative methods included intermittent positive and negative pressure[28], intermittent venous occlusion[29] and the oscillating bed. Surgical extraction lagged well behind these conservative treatment modes[30].

Various methods of performing embolectomy were tried, including direct arteriotomy, retrograde flushing of the arterial tree[31,32], the use corkscrew wire devised by Shaw[33], and various suction devices[34].

One of the great advances in treatment of patients with thromboembolism given by Murray[35] in 1933, the introduction of heparin for use before, during, and after surgical

intervention. Intravenous heparin infusions decreased the propagation of thrombus, stabilized the clot, and recruited collateral vessels.

Early in its evolution, the complete removal of thromboembolic material, especially when associated with large amounts of propagated thrombus, remained problematic. A variety of methods, including suction catheters, vigorous arterial flushing, and external compression on the limbs, were used with moderate success.

In 1963, Fogarty[36] and associates proposed the use of a balloon catheter that offered a significant advance for the retrieval of thrombus, distal and proximal to the embolic site.

Lavenson[37] and co workers and Yao[38] and co workers suggested that measurements of distal arterial pressure in the extremities may offer valuable information in assessing limb viability. They suggested that distal pressures below 30 mm Hg often are associated with eventual limb loss.

AIM

To evaluate the perioperative outcome of all patients presented with first episode of acute arterial occlusion of lower limbs to our department for the period of two years.

MATERIALS AND METHODS

Design of the study: Prospective

Study period: February 2007 to February 2009

All patients presented with acute lower limb ischemia to the Department of vascular surgery, Madras Medical College, Chennai over the above period were studied. The patients presented for the first episode alone were included in the study. Vascular examination was done thoroughly in all patients.

They were classified according to the Rutherford's classification of acute limb ischemia, duration of ischemia, level of occlusion, associated risk factors, probable etiological factor and treatment offered.

All patients were investigated preoperatively by echocardiography and looked for the source of embolism. In selected group of patients, preoperative angiograms were done depends on the severity of ischemia. Those patients presented with limb threatening ischemia were taken up directly to the operation theatre after minimum basic investigations.

The patients included in the study were divided according to the etiology of embolism or thrombosis. The diagnosis of embolism or thrombosis was determined from a

consideration of history, clinical examination, presence or absence of clot in echocardiography and angiography.

All patients who had undergone surgeries alone were taken up for the study. The patients being managed conservatively with oral anticoagulation or thrombolytic agents were excluded from the study. Only those who underwent surgeries alone were analysed for category improvement, outcome including the mortality during the in hospital postoperative period.

Inclusion criteria

First episode of Acute Lower extremity Ischemia

Acute Thrombosis

Acute Embolism

Exclusion criteria

Multiple thromboembolism involving other regions

Recurrent thrombosis

Bypass Graft Thrombosis

Dissection

Trauma

DVT gangrene

Septic arterial occlusion

Depending on the limb viability status and irrespective of the duration of ischemia, all patients were undergone revascularization procedures in emergencies as well as in elective theatres. All limb threatening ischemia patients underwent emergency embolectomy or thrombectomy and patients with non limb threatening ischemia were angiographically evaluated and subjected for elective bypass procedures. Compartmental fasciotomy were done as and when required during the postoperative period. All patients presented with irreversible ischemia underwent amputations were also included in the study. Patients who had successful outcome following revascularisation in the postoperative period were made ambulant independently and following amputations with walking frame.

Secondary major amputations and minor amputations were performed for patients those advanced ischemia and depending on the line of gangrene demarcation respectively, following revascularization.

All patients were started on therapeutic heparinisation soon after admission. This was continued postoperatively.This was slowly overlapped with oral anticoagulation only when the revascularised limb do not require any further surgical intervention before the time of discharge.

STATISTICAL ANALYSIS

This study was statistically analysed by the Chi-square test to compare the duration, level, etiology and severity of ischemia to the outcome and mortality.

OBSERVATION AND RESULTS

A total number of 60 patients were admitted to the department of vascular surgery with acute lower limb ischemia over the two year period. Out of this, 41 patients required surgeries and were prospectively analysed. Rest of the others were not included in the study. They were predominantly of males(Male : Female ratio, 34 : 7).

The age of presentation was ranged from 23 to 70 years and a mean of 42.3 years.

The duration of ischemia from the time of onset of symptom to admission was ranged from 12 hours to a maximum of 25 days, mean of 6.7 days.

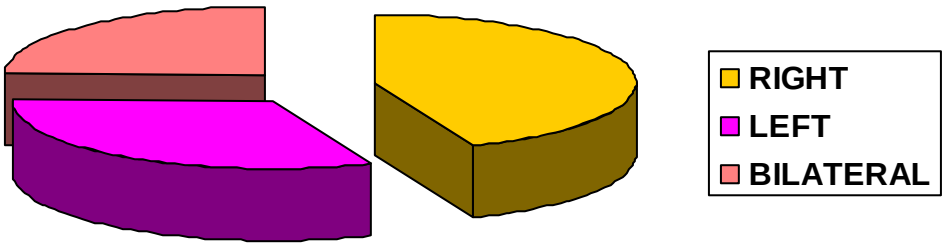
Symptoms

In our study, only five patients had previous history of claudication, out of which only one patient was having embolic etiology which was neglected for 20 days. He presented with incapacitating claudication.

Majority of the patients had presented with more than 4 p’s.

Affected side

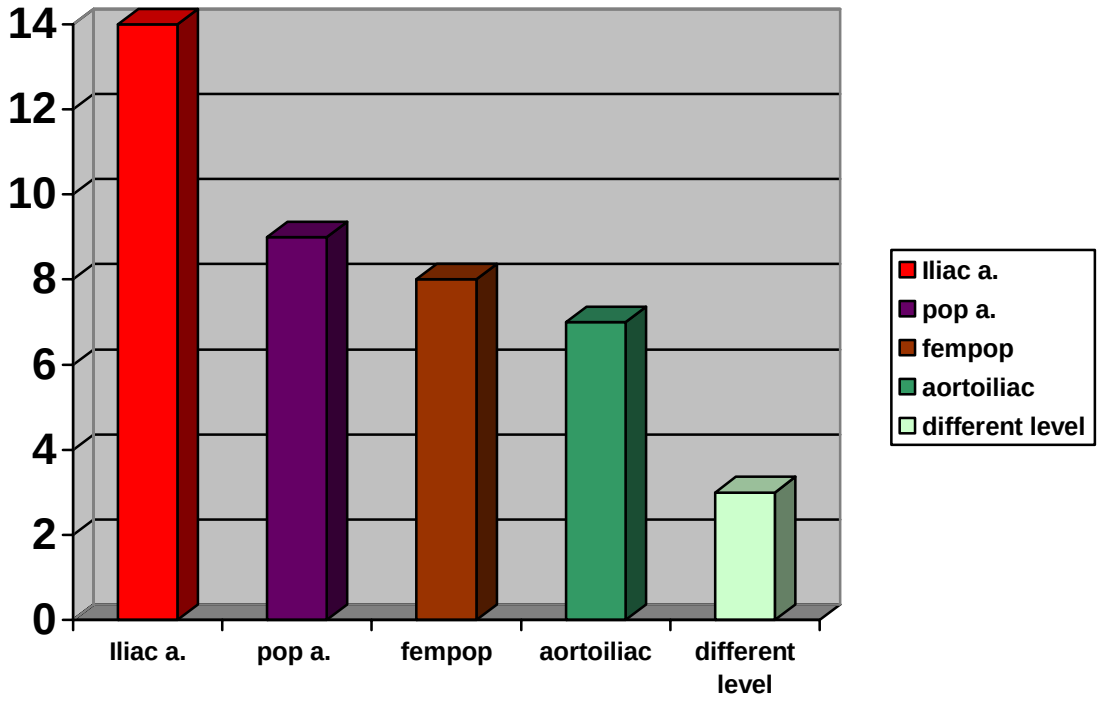
In our study, 18 patients presented with right lower limb involvement, 13 patients with left lower limb and 10 patients with bilateral lower limb involvement.



Anatomical level

Out of 41 patients, majority(14 patients)of them had iliac artery occlusion, nine had popliteal artery and eight had femoropopliteal artery occlusion.

Out of the 10 bilateral limb involvement, seven had aortoiliac occlusion and three patients had different level of occlusion in two different limbs, and seven were in the embolism group. In aortoiliac occlusion, five out of seven had saddle embolism(71%)



Ankle Brachial Index(ABI)

In the study, 35 patients detected to have no flow in the hand held Doppler at the time of presentation, four had decreased ABI and one had venous flow.

Class	**Pre op ABI**		
	No flow	**Decrease**	**Venous**
I	5	2	0
IIa	3	1	0
IIb	9	1	1
III	16	0	0
Both	3	0	0
Total	36	4	1

Risk factors

Out of 41 patients, only 19 patients were associated with comorbid illness.

Most of the patients(10 patients, 24%) had previous history of rheumatic heart disease(RHD) with severe mitral stenosis(MS). Transthoracic echocardiography(TTE) could pick up cardiac source of embolism in only four of these patients(out of 10).The rest of them were not subjected for transesophageal echocardiography(TEE) for want of availability. Four patients associated with coronary artery disease(CAD), diabetes mellitus(DM) and hypertension(HTN), two patients had CAD alone, two had HTN and cerebrovascular accident(CVA) and one had history of diarrhea.

Out of the 41 patients, four patients had atrial fibrillation of which three were associated with RHD and MS and one with CAD alone who also had ascending aortic aneurysm.

Risk Factors	**n**	**Embolism**	**Thrombosis**	**Clot in the cardiac chamber**
RHD, severe MS	10	10	0	4
CAD, DM, HTN	4	3	1	2
CAD alone	2	2	0	0
HTN, CVA	2	0	2	0
Diarrhoea	1	0	1	0

Majority of the patients (n = 32, 78%) were smokers, all of them were male patients.

Rutherford's classification of acute limb ischemia

According to the Rutherford's classification, 16 patients were presented with class III ischemia, 11 patients with class IIb, four patients with class IIa and seven with class I, and three other patients with both classes of IIa and IIb in two different limbs.

Rutherford's Class	Number of patients(%, percentage)
I	7(17%)
IIa	4(9%)
IIb	11(26%)
III	16(39%)
IIa & IIb	3(7%)
	Total 41

Echocardiography

In our the study, six showed intracardiac clot as the source of embolism, out of which four were associated with RHD and two with CAD and one also with ascending aortic aneurysm.

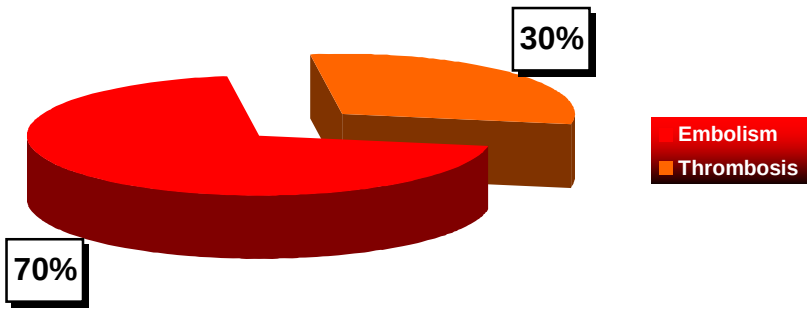
Class IIb, Limb threatening Ischemia

Class III Ischemia, after surgical attemption – subsequently Secondary amputation

Class III, Irreversible ischemia

Probable Etiology

Most of our patients(n = 29, 70%) had embolism and other 30%(12 patients) were having thrombosis due to arteriosclerosis in 9 patients, thromboangiitis obliterans in two and hypercoagulable in one patients.



Angiography

Seven patients were subjected for computed tomography angiogram, out of which four had thrombosis and three had embolism. Two other patients underwent conventional angiography and intraoperative angiography. Out of these patients, four were in class I, three were in class IIa and two were in class III ischemias.

Out of these four thrombosis, three underwent bypass procedures and one underwent primary amputation. Out of three embolism group patients, two underwent bypass and one underwent embolectomy.

Surgeries performed

Most of the surgeries were carried out as an emergency procedures.

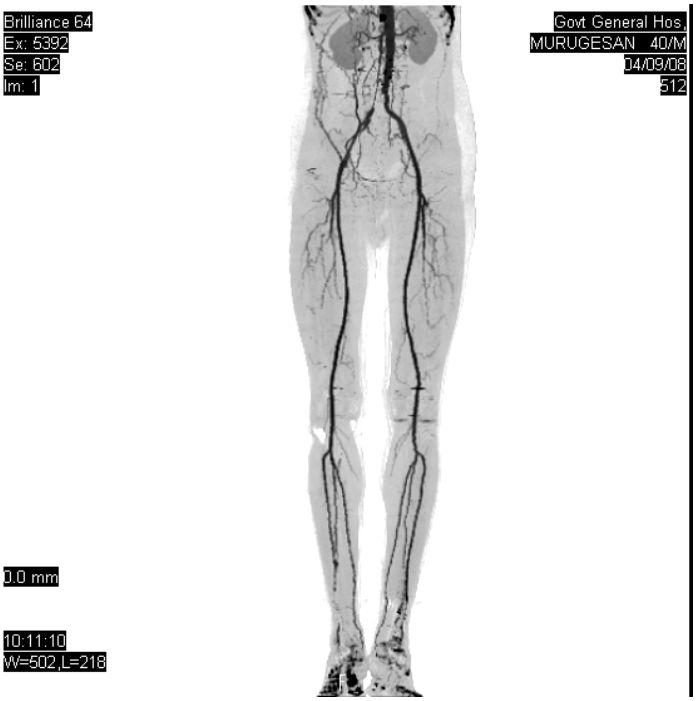
Unilateral femoral artery embolectomy in 13 patients(12 were done in emergency and one in elective for class I ischemia), out of which four patients were in class III ischemia. Unilateral femoral artery thrombectomy, both femoral and popliteal thrombectomy and embolectomy in each of three patients.

Out of the 10 bilateral limb involvement, seven of them underwent emergency femoral embolectomy, others underwent femoral thrombectomy, aortoiliac artery bypass and primary above knee amputation in one limb with other limb salvaged with forefoot amputation done for class III ischemia in each of the three patients.

Unilateral popliteal artery embolectomy were done in four patients and thrombectomy in two patients.

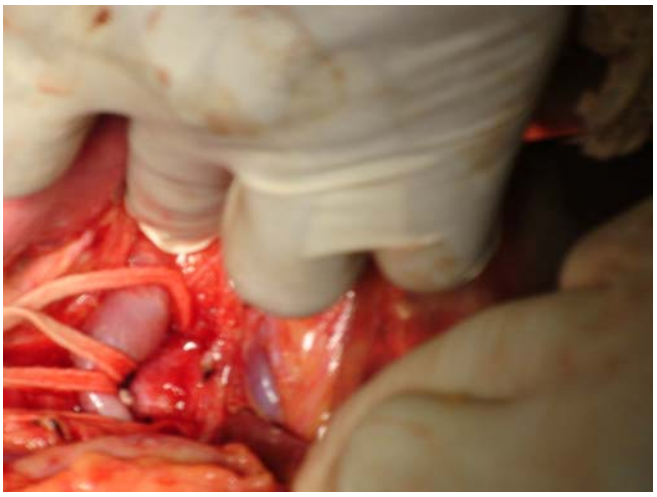
45 year old male Juxta renal aortic thrombotic occlusion presented with class I ischemia of left lower limb.

This patient is known claudicant with right iliac artery occlusion on conservative management

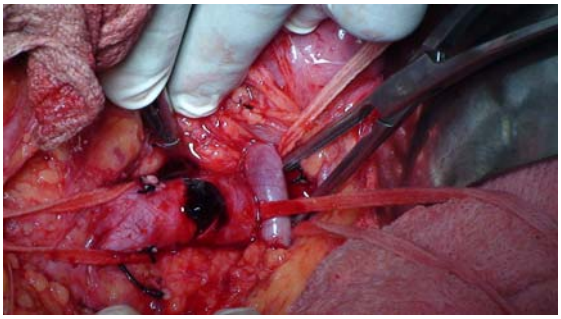


CT Angiogram showing right iliac artery occlusion

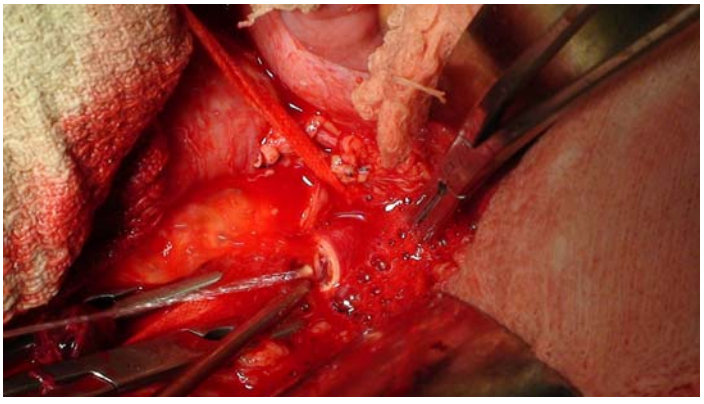
SURGICAL PROCEDURE



Infrarenal aortic thrombectomy

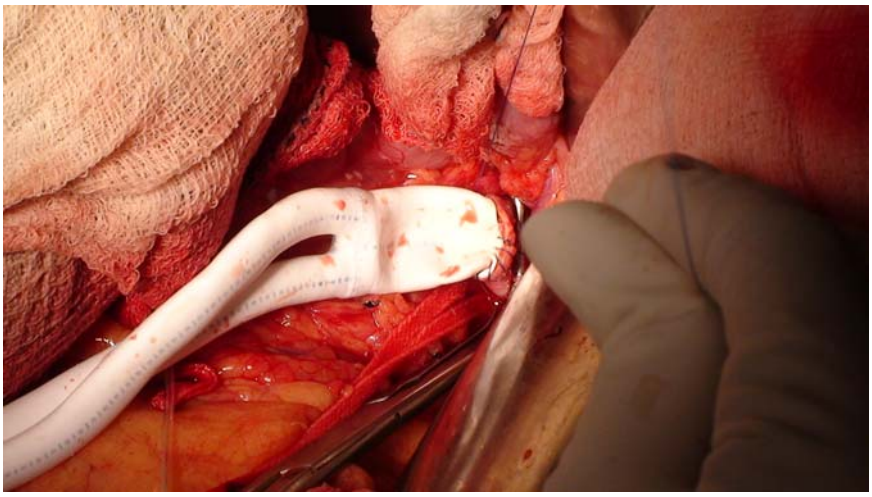


Aorta declamped

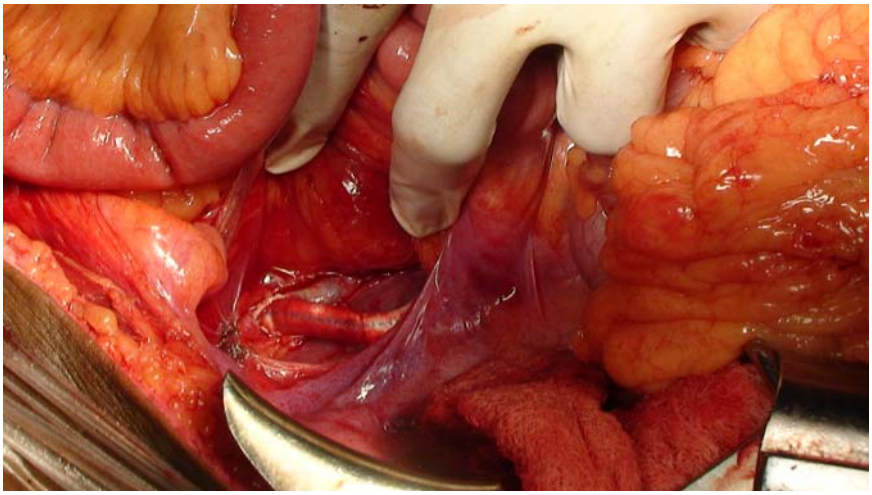


Aorto Bi Iliac artery 14/7 mm PTFE bifurcated Bypass grafting

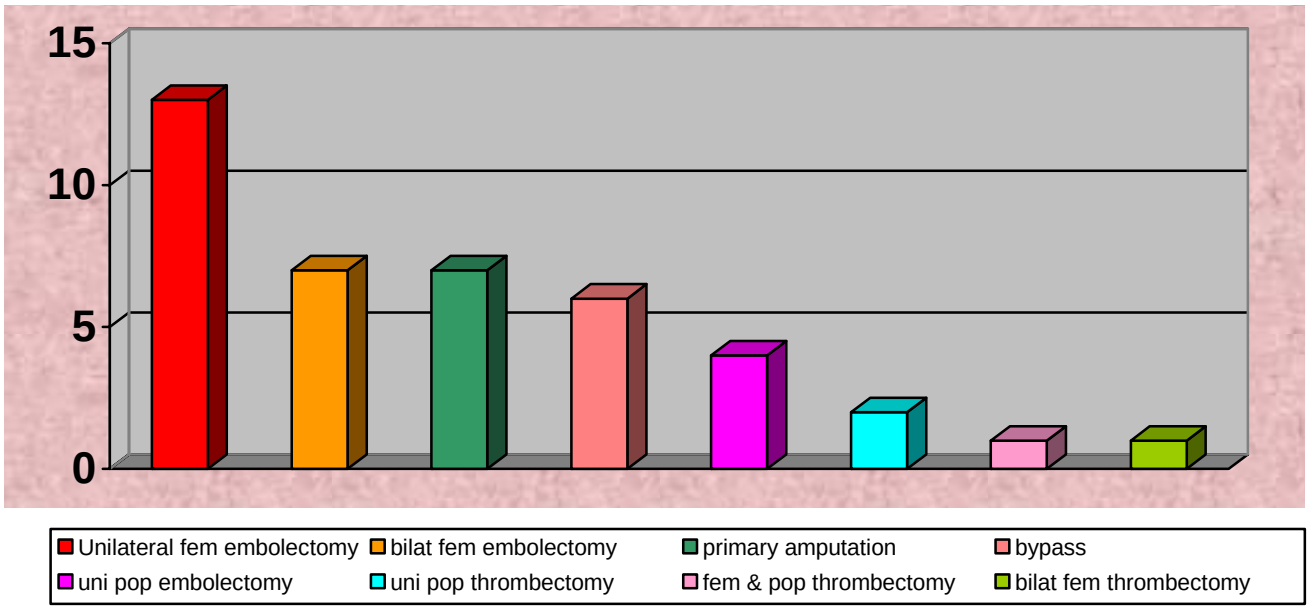
Proximal anastomosis



Distal anastomosis



Postoperatively, patient was ambulant normally, with ABI -1.0 in both lower limbs



Bypass procedures were performed in five patients, out of which aorto biliac in one patient for class I ischemia due to aortoiliac artery thrombosis, aortounifemoral artery bypass grafting done in one patient for left iliac artery thrombosis presented as class IIa and infrainguinal bypasses done in three patients(CFA to mid SFA -1, CFA to PTA – 1, proximal to distal popliteal artery – 1) for class I ischemia. Two of them were due to embolism.

Primary amputations were done in six patients, five for unilateral limb ischemia(above knee in four and below knee in one patients) and in one patient for bilateral limb ischemia where right above knee amputation was done.

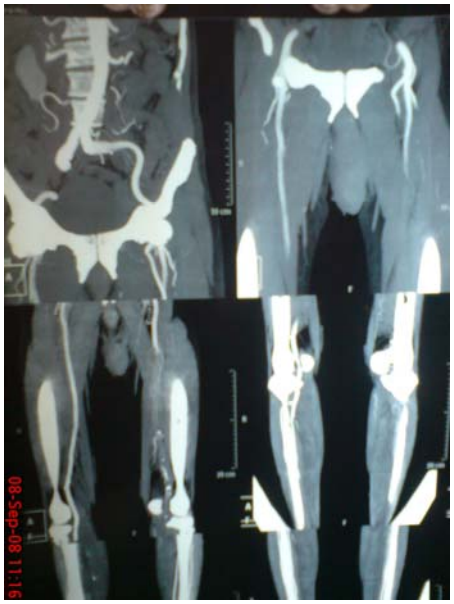
Majority of the patients underwent leg fasciotomy following embolectomy or thrombectomy.

70 year old male presented after 15 days with class I ischemia of left LL

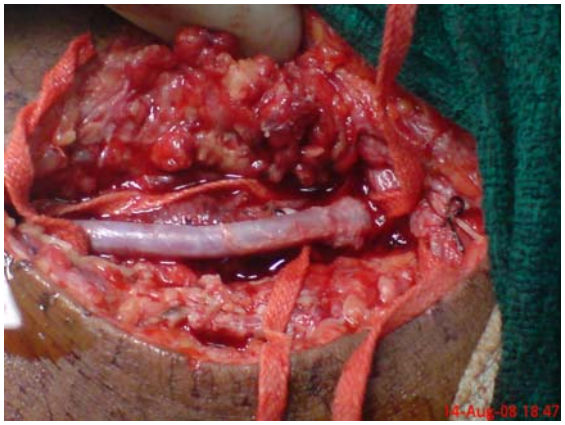
Echocardiography showed Ascending Aortic Aneurysm

On CT angiographic evaluation showed left external iliac artery was tortous , SFA loaded with thrombus and distal reformation of posterior tibial artery

Right LL tibial arterial occlusive disease



Common femoral artery to posterior tibial artery reversed sapheous vein bypass



Proximal

Distal

45 year old male known c/o RHD, Severe MS for 20 years

Stopped anticoagulation and also not willing for surgery

He presented with class III ischemia due to femoral artery embolism

Embolectomy + fasciotomy was done

Patient with foot drop splint and ambulant with walking frame

Unfortunately, patient developed groin wound infection with femoral artey blow out which was ligated. Subsequently he required an Above knee amputation and expired.

Cause of death: Multifactorial (Cardiac, Sepsis and 3 times emergency surgery)

45 year old male with bilateral LL ischemia, Right IIb and Left IIA

Bilateral femoral artery embolectomy done, Distal pulses reappeared

Both leg fasciotomy, anterior compartment muscles non viable, debrided

Postoperatively patient developed hematuria, respiratory distress – later EXPIRED

Relationship of level of occlusion to the outcome in acute lower limb ischemia

Level	Outcome				
	Limb Salvaged		Amputation	Expired	Total
	Normal	With disability			
Aortoiliac	1	1	2	3	7
Iliac	7	3	3	1	14
Fempop	4	0	1	3	8
Popliteal	4	2	3	0	9
Both	0	2	0	1	3
Total	16	8	9	8	41

P = 0.18002, not significant

In our study, both iliac(41.7%) and popliteal(25%) arterial level of occlusion had favourable outcome compared to other levels of occlusion for limb salvage.

At the same time the rate of amputation was higher in both these levels(33.3% each). The reason for the higher rate was all of them were in class III ischemia. This difference is not statistically significant.

Duration of ischemia to the mortality

Days	**Mortality**		
	Yes	**No**	**Total**
< one week	8	21	29(70.7%)
>one week	0	12	12(29.3%)

P < 0.05, significant

We observed that, majority(70.7%) of the patients presented within a week duration of ischemic symptoms. And also all the patients died were in the less a week group. Out of which 75% were in embolism group and in class III ischemia. The reason of this higher mortality could be due to the associated cardiac morbidity as well as the severity of ischemia.

At the same time, all of them presented after one week underwent surgery were survived. In this majority were in embolism group(8 out of 12 patients). This was statistically significant.

Comparison of side of ischemia to the mortality

Side	Mortality		
	Yes	**No**	**Total**
Right	4	14	18
Left	0	13	13
Bilateral	4	6	10

P = 0.5212, not significant

The side does not have any influence in the outcome. Although, there is 40% mortality in the bilateral limb ischemia patients. This difference is not statistically significant.

Relationship of preoperative ABI with outcome

Preop ABI	Outcome				
	Limb salvaged				
	Normal	**With disability**	**Amputation**	**Expired**	**Total**
No flow	12	7	9	8	36
Decreased	3	1	0	0	4
Venous	1	0	0	0	1

P = 0.51891, not significant

The above table compares the outcome of patients with preoperative Doppler audio signals in acute lower limb ischemia. There is no significant difference noted in these groups.

Comparison of the level of ischemia with the mortality

Level		**Mortality**	
	Yes	**No**	
Aortoilac	3	4	7
Iliac	1	13	14
Fempop	3	5	8
Pop	0	9	9
Both	1	2	3

P = 0.09202, not significant

Iliac and popliteal arterial level of occlusions were having better survival rate(> 90%) when compared to that of aortoiliac and femoropopliteal arterial occlusions. Although the level of occlusion was not statistically significant to that of the mortality, we found that 42% of the saddle aortoiliac occlusions were died. Conversely, 37% of mortality rate was found in lower level occlusions also e.g. femoropopliteal level.

Relationship of etiology and mortality

Etiology	Mortality		
	Yes	**No**	**Total**
Embolism	6	23	29
Thrombosis	2	10	12

P = 0.76742, not significant

Although the mortality in our study was higher in the embolism group compared to that of thrombosis group, the difference is not statistically significant. Because fewer number of cases in thrombosis group and the mortality in this group reflects the sequelae of cardiac disease.

Relationship of etiology with the outcome

Etiology	Outcome			
	Limb salvaged	**Major Amputation**	**Expired**	**Total**
Embolism	17	6	6	29
Thrombosis	7	3	2	12
Total	24	9	8	41

P = 0.93129, not significant

In our study, the overall limb salvage rate and major amputation rate both primary and secondary were 58.5% and 22%, respectively.

When etiology was related to that of limb salvage, the limb survival for both embolism and thrombosis were 58.6% and 58.3%, respectively. There is not much of any differencein both the groups. And the major amputation was also nearly equal for both the groups(Embolism - 20.7%, Thrombosis - 25%). Our thrombosis group were relatively small in numbers. We considered the etiology of thrombosis in our patients who had prior history of claudication and or had lower limb muscle wasting. In few cases, angiography were sufficient to permit the accurate diagnosis of thrombosis.

The mortality was higher in the embolism group(20.6%) compared to the thrombosis where the mortality rate was 16.6%. This difference was not statistically significant (P = 0.93129).

Limb salvagibility to the class of ischemia

Class	Outcome			
	Limb salvaged	**Major amputation**	**Expired**	**Total**
I	7	0	0	7
IIa	4	0	0	4
IIb	11	0	0	11
III	1	9	6	16
Both	1	0	2	3
Total	24	9	8	41

P < 0.001, Highly significant

The outcome of patients according to the Rutherford class were analysed, we found that all patients presented with class I, IIa and IIb were having 100% limb salvagibility, whereas only one patient of class III ischemia limb was salvaged. But the only difference between class IIa and IIb, the limb salvage with disability was higher, i.e., 62.5% compared to that of class IIa(12.5%).

Limb salvagility is considered when the patient is completely ambulant normal and or with minor neurological deficit or underwent minor amputation.

Other patients of class III ischemia(n=9), had undergone either a primary or secondary major amputation and six patients were died. Secondary amputations were required in patients where limb salvage was attempted and failed and also in one patient following primary below knee amputation who needed above knee for the ischemic stump.

All patients who underwent major amputation both primary or secondary were in class III ischemia. This difference was statistically significant($p<0.001$). Precisely, the rate of limb salvage, limb salvage with diability, major amputation was 39%, 19.5% and 22%, respectively. Those who died were considered as limb salvage failures.

The Mortality comparison with the outcome

Mortality	**Outcome**			
	Limb salvaged	**Major amputation**	**Expired**	**Total**
Yes	0	0	8	8
No	24	9	0	33
Total	24	9	8	41

P < 0.01, significant

In our study, when the outcome of patients were compared with the mortality, we found that none died following amputation including the secondary amputation following the surgical attemption for limb salvage. This difference was statistically significant($p < 0.001$). The causes of mortality were more due to associated cardiac illness in three patients and due to sepsis and rhabdomyolysis in each, of two patients.

The Mortality comparison with the Rutherford's class of ischemia

Class	Mortality	
	Yes	**No**
I	0	7
IIa	0	4
IIb	0	11
III	6	10
Both	2	1
Total	8	33
Percentage	**19.5**	**80.5**

P = 0.01189, significant

In our study, the overall mortality rate was 19.5%, i.e., 8 patients out of 41 patients were expired(75% were in class III and 25% were both lower limb different level ischemias). We found that 37.5% of patients with class III ischemia and 66.7% of both lower limb ischemia with different level occlusion were expired.

The overall mortality rate of bilateral lower limb ischemia was 40% and that of the saddle aortoiliac occlusion was 42%. Out of this, saddle embolism and thrombosis had 60% and 0% mortality rate, respectively.

DISCUSSION

This study, a two year prospective study conducted at Department of Vascular surgery, Madras Medical College, Chennai, demonstrates that embolism is still one of the most common causes of acute lower limb ischemia and also the serious vascular emergencies.

In our study, the iliac artery occlusion is the most frequent site of occlusion as compared to that of femoral artery bifurcation in many studies[39,40,24]. And femoral artery stands as the second most frequent site of occlusion and aortoiliac constitutes around 18% which is comparable to other studies.

The overall mortality rate in our study was 19.5%. Mills and Porter[41] found that the overall mortality was 12.5% in their series but higher rates ranging from 25 to 48% were noted in earlier reports[42,43,44]. Patients are in the middle age and the mean age was 40 years. 75% of the mortality were in males. The operative outcome depends on many risk factors.

In 1984, a study done by Richard et al[45] at Massachussets General Hospital and Harvard Medical School, Boston, the mortality was higher in patients with embolic occlusion(20%) and it was 8% in thrombosis. Even in our study, the embolic group had higher mortality (20.6%) when compared to the thrombotic group(16.6%). On the contrary, their rate of limb salvage was superior in patients with thrombosis compared to our study where both the groups had nearly equal rates.

The presumed origins of cardiac emboli were evident in 48% and rest of 52% could not be accurately determined. In a France study done by Jean- Pierre Becquemin and Stephane Kovarsky[46] from the data collected from 24 centres showed that 33% did not show the origin of embolism. Also, they found that in 6% of patients echocardiography revealed the presence of intracardiac thrombus in patients with heart disease compared to that of 42% in our study revealed intracardiac thrombus.

Several studies have shown that older patients have a higher mortality than younger and the mortality is higher in the proximal occlusions compared with distal occlusions[47,48,49]. But in our study, the mean age of patients died was 37 years and 62.5% of patients had above iliac level occlusion. The higher the mortality could be because of associated rheumatic heart disease in 50%(four) of our patients and 75% were males.

Even in the past reports have shown that patients presenting with acute peripheral arterial occlusion were often in the 5th decade of life[50,51,52]. This represented the era of rheumatic heart disease associated with mitral valve deformity and resultant distal embolization were the most common causes of ischemia.

Susequent data demonstrated that the mean age of patients with acute peripheral arterial occlusion was 70 years, reflected a shift in etiology from rheumatic to atherosclerotic heart disease and the increased frequency of peripheral atherosclerosis as an inciting cause for occlusion.

Surprisingly, in our study also it is going back to the past. Majority of our patients were in 4th decade and represented the rheumatic heart disease as the most common cause of acute ischemia. Atherosclerotic heart disease and peripheral atherosclerosis the second cause of our study both in embolism and thrombosis.

In Dregelid et al[53] patients with severe ischemia secondary to a proximal iliac occlusion had worst prognosis, with a 20% mortality and 40% amputation rate.
Conversely, in our study iliac artery level occlusions were having better survival rate, limb salvage as well as higher amputation rates, 92.8%, 41.7%, 33.3%, respectively.

A short duration of symptoms prior to embolectomy has been reported to increase mortality[54,55] while others have found no effect on mortality[49,50,51,56]. In our study, also all of those patients died were presented less than a week duration prior to surgery. Probable explanation would be those patients delayed in presentation would have had time to improve the general condition and taken time for the development collateral circulation prior to surgery. And also patients who had class III ischemia arrived to early for the treatment and for whom delay in procedure could not be done for the fear of limb loss. Hence, there was no time for stabilizing these patients before surgery was undertaken.
In our study the overall amputation was 22% as comparable to that of studies by Ljungman and Mills et al were amputation rates were ranged from 20 to 40%[41,42]

Like Kendrick et al[57], McPhail et al [58] and Elliot et al[59], our findings also indicate that the duration ischemia before treatment was a risk factor for death.

According to Levy et al[43], severe ischemia did not increase the mortality whereas, Balas et al[60] reached the opposite conclusion. In our study, 75% were in class III and rest of 25% were having bilateral limb involvement. According to Richard et al, it is the preexisting disease largely determines prognosis regardless of the severity of ischemia[61,62] and contradicts the notion that most of the deaths are caused by revascularization of the ischemic limb[23].

It is acknowledged that the severity of ischemia may be equally important as the amount of ischemic tissue concerning limb survival[53].

In our study of bilateral lower limb presentation, 75% had aortoiliac occlusion, out of this the mortality rate was 42%. This is nearly comparable with a retrospective study of acute aortic occlusion by Sateesh et al[63] where the mortality rate was 52%.

CONCLUSION

- Embolism is still the commonest causes of acute lower limb ischemia and cardiac is the commonest source.

- Rheumatic heart disease is still more prevalent in our population even though there is a changing trend in the disease pattern towards atherosclerotic heart disease and peripheral atherosclerosis.

- Even though it appears that the incidence of rheumatic heart disease is seemingly decreasing, the need of penicillin prophylaxis for rheumatic fever should be encouraged in the lower socioeconomic groups. The increased incidence of embolism could be due to non compliance of oral anticoagulation therapy and inadequate anticoagulation due to lack of monitoring.

- Class III ischemia is the commonest presentation, probably because of lack of awareness in the public and availability of expertise.

- Though the patients presented within a week of the onset of symptoms, the mortality in these patients were high. This could be due to various reasons, in limbs with class III ischemia as a consequence of which there will be metabolic derangements and also the need for urgent intervention without improving the general condition. So, this could be minimized by improving the general condition in those categories of patients where delay would not worsen the ischemia.

- Class III ischemia defined by Rutherford's classification is based on paralysis with absence of venous signal by hand held Doppler. But however, the patients fulfilling the above criteria extends from the total insensate limbs and skin changes. Should we give a chance for revascularising in those patients with sensorymotor deficit without skin changes. In limbs with paralysis with absence of venous signal which are seemingly salvageable, the decision should be made in the operation theatre.

- A small group of patients those from class IIB to III, the decision of primary amputation should be considered in operation theatre. Consent should be obtained for limb salvage procedure as well as amputation. The feasibility of revascularization should be assessed by an on table angiogram. If we salvage the limbs with myonecrosis, they will end up with permanent functional loss. The long term follow up of these patients are necessary before usefulness of attempting revascularization.

- The severity of ischemia carries a very high risk of mortality and limb loss even with aggressive revascularization. Hence, class III ischemia should be advised primary amputation as a life saving measure(since all class III ischemia patients who underwent primary amputation survived).

- All patients present with class IIa /IIb ischemias should be operated whenever feasible as the limb salvage rate is very good.

- Patients with bilateral ischemia, though with class IIa/IIb have significant mortality. This may be due to the extent of tissue damage contributing to increased ischemic metabolites. The mortality may be reduced by intensive perioperative monitoring, postoperative ventilatory support and correction of

acidosis. Sequential declamping and intermittent reperfusing the limbs are mandatory.

- Other modalities of treatment like thrombolytics and or anticoagulation alone should be considered for non limb threatening ischemia.

- The benefit of limb salvage surgery must be weighed against the risk of increased mortality and the choice of treatment should be based on the influence of relevant factors on survival rates and amputation.

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PROFORMA

Serial No:
Name: Age/Sex:
IP NO: Address:
DOA: DOS: DOD: DOEx:

Clinical presentation

H/o Intermittent Claudication – Yes/No
H/o rest pain/bluish or blackish discoloration/numbness/weakness
H/o CVA/TIA/chest pain/palpitation/abdominal angina/urinary complaints/prev surgery or interventions

Onset - AM
PM

Duration - Hours/ days

- Pain
- Pallor AK/BK/BA
- Paresthesia AK/BK/BA
- Paralysis Motor deficit – partial/total
- Poikilothermia AK/BK/BA
- Pulseless

	RT	LT
Fem	0/1/2/3	0/1/2/3
Pop	0/1/2/3	0/1/2/3
AT/DP	0/1/2/3	0/1/2/3
PT	0/1/2/3	0/1/2/3

0-Absent, 1-Feeble, 2-Normal, 3-Bounding

Bilateral Upper limb pulses

	RT	LT
Fem	TP/BP/MP/Thump	TP/BP/MP/Thump
Pop	TP/BP/MP/Thump	TP/BP/MP/Thump
DP	TP/BP/MP/Thump	TP/BP/MP/Thump
PT	TP/BP/MP/Thump	TP/BP/MP/Thump
PT Venous	Yes/No	Yes/No
ABI		

Anatomical level Unilateral – Right / Left
Aortoiliac/ iliac/ femoral/ popliteal/ tibial/ pedal

Rutherford Class – I / IIa /IIb / III

Etiology – embolic/ thrombosis
Embolic source - Cardiac / Aneurysm / proximal artery/ unknown
Thrombosis – TAO / ASO / Vasculitis / Hypercoagulable/ Iatrogenic

Risk Factors
DM/HTN/CAD/RHD
Details -
Smoking – Beedies/Cigarette - years

Investigations
Hb - PCV- Platelets- TC- DC-
RBS-
Urea-
Creat- ESR - CRP -

ECHO
LV Diastolic/Systolic dysfunction
LVEF –
Clot – Yes/No

Angiography –Conventional/DSA/64 slice CT/MRA

Treatment – Heparin alone / Thrombolysis / Surgery

Surgery - Thrombectomy - Emg/Semielective
Embolectomy - Emg/Semielective
Bypass – Autologous/Synthetic
Primary amputation

Outcomes

	RT	LT
ABI		

Limb salvage – Ambulation/Minor Amputation

Secondary Major amputation - BKA/AKA/Knee/Hip disarticulation

Mortality

Morbidity – Stump ischemia or infection/delayed wound healing/ footdrop/RF/MI/Stroke/Respiratory/

							MASTER CHART				
Serial No.	**AGE**	**Sex**	**Days**	**No. p**	**Class**	**SIDE**	**Level of Occlusion**	**Pre op ABI**	**Risk factors**	**Smoking**	**ETIOLOGY**
1	45	M	4 days	4ps	III	Right	Popliteal	no flow		smoking	Embolic
2	70	M	15 days	2ps	I	Left	Fempop	no flow	CAD	smoking	Embolic, Asc AAA
3	41	M	25 days	2ps	I	Right	Fempop	no flow	HTN old CVA	nil	ASO, Thrombosis
4	55	M	one day	4ps	IIB	Left	Iliac	no flow		smoking	Embolic
5	25	M	3 days	5ps	III	Right	Fempop	no flow	RHD, MS, AF, CCF		Embolic
6	45	M	2 days	2ps	I	Bilateral	Aortoiliac	0.4, 0.27	HTN old CVA	smoking	ASO, Thrombosis
7	35	M	4 days	5ps	III	Right	Popliteal	no flow		smoking	Embolic
8	35	M	one day	5ps	III	Left	iliac	no flow		smoking	Embolic
9	35	M	7 days	2ps	IIA	Right	Popliteal	no flow		smoking	TAO Thrombosis
10	37	M	15 days	5ps	III	Bilateral	Aortoiliac	no flow		smoking	ASO, Thrombosis
11	42	M	5 days	5ps	III	Left	Popliteal	no flow	DM, HTN, CAD	smoking	ASO, Thrombosis
12	35	M	4 days	5ps	III	Left	Iliac	no flow		smoking	Hypercoagulable
13	48	M	one day	3ps	Rt III, Left IIA	Bilateral	Lt iliac rt fempop	no flow	RHD severe MS	smoking	Embolic
14	37	M	4 days	4ps	III	Right	Iliac	no flow		smoking	TAO Thrombosis
15	38	M	7 days	5ps	IIB	Right	Iliac	no flow		smoking	Embolic
16	38	M	20 days	3ps	I	Left	Fempop	no flow		smoking	Embolic
17	52	M	7 days	4ps	IIB	Left	Popliteal	0.2	DM, HTN, CAD	smoking	Embolic
18	38	M	8 days	3ps	I	Right	Iliac	no flow	CAD	smoking	Embolic
19	45	Female	15 days	2ps	I	Left	Iliac	0.6	RHD severe MS		Embolic
20	65	M	7 days	3ps	IIA	Right	Popliteal	no flow		smoking	ASO, Thrombosis
21	35	M	10 days	5ps	III	Bilateral	Aortoiliac	no flow		smoking	Embolic
22	52	M	12 hours	4ps	IIB	Left	Iliac	no flow	RHD, MS, CMV done	smoking	Embolic
23	35	M	8 days	4ps	IIB	Right	Fempop	venous		smoking	ASO, Thrombosis
24	45	M	7 days	5ps	III	Right	Fempop	no flow	RHD severe MS	smoking	Embolic
25	27	M	4 days	5ps	III	Right	Fempop	no flow		smoking	Embolic
26	45	M	2days	4ps	Rt IIB, Left IIA	Bilateral	Aortoiliac	no flow		smoking	Embolic
27	55	M	2 days	4ps	Rt IIB Lt IIA	Bilateral	Rt iliac and Lt fempop	no flow	Diarrhoea	smoking	ASO, Thrombosis
28	28	Female	4 days	4ps	III	Bilateral	Aortoiliac	no flow	RHD severe MS		Embolic
29	35	Female	5 days	4ps	III	Bilateral	Aortoiliac	no flow	RHD severe MS		Embolic
30	39	M	5 days	3ps	IIA	Right	Popliteal	no flow		smoking	ASO, Thrombosis
31	49	M	10 days	4ps	IIB	Right	Iliac	no flow		smoking	Embolic
32	55	M	14 days	3ps	IIA	Left	Iliac	0.2		smoking	ASO, Thrombosis
33	23	Female	2 days	5ps	IIB	Bilateral	Rt fempop Lt iliac	no flow	severe MS, CVA, lt hemiplegia		Embolic
34	52	M	4 days	4ps	IIB	Left	Popliteal	no flow	DM, HTN, CAD	smoking	Embolic
35	40	Female	one day	5ps	IIB	Right	Iliac	no flow	RHD, CVA		Embolic
36	60	M	one day	4ps	IIB	Right	Popliteal	no flow	DM, HTN, CAD		Embolic
37	30	M	20 days	2ps	I	Right	Iliac	no flow		smoking	Embolic
38	35	Female	4 days	5ps	IIB	Bilateral	Aortoiliac	no flow	RHD severe MS		Embolic
39	50	Female	10 days	5ps	III	Right	Fempop	no flow			Embolic
40	40	M	3 days	5ps	III	Left	Iliac	no flow		smoking	Embolic
41	45	M	4 days	5ps	III	Left	Iliac	no flow		smoking	Embolic